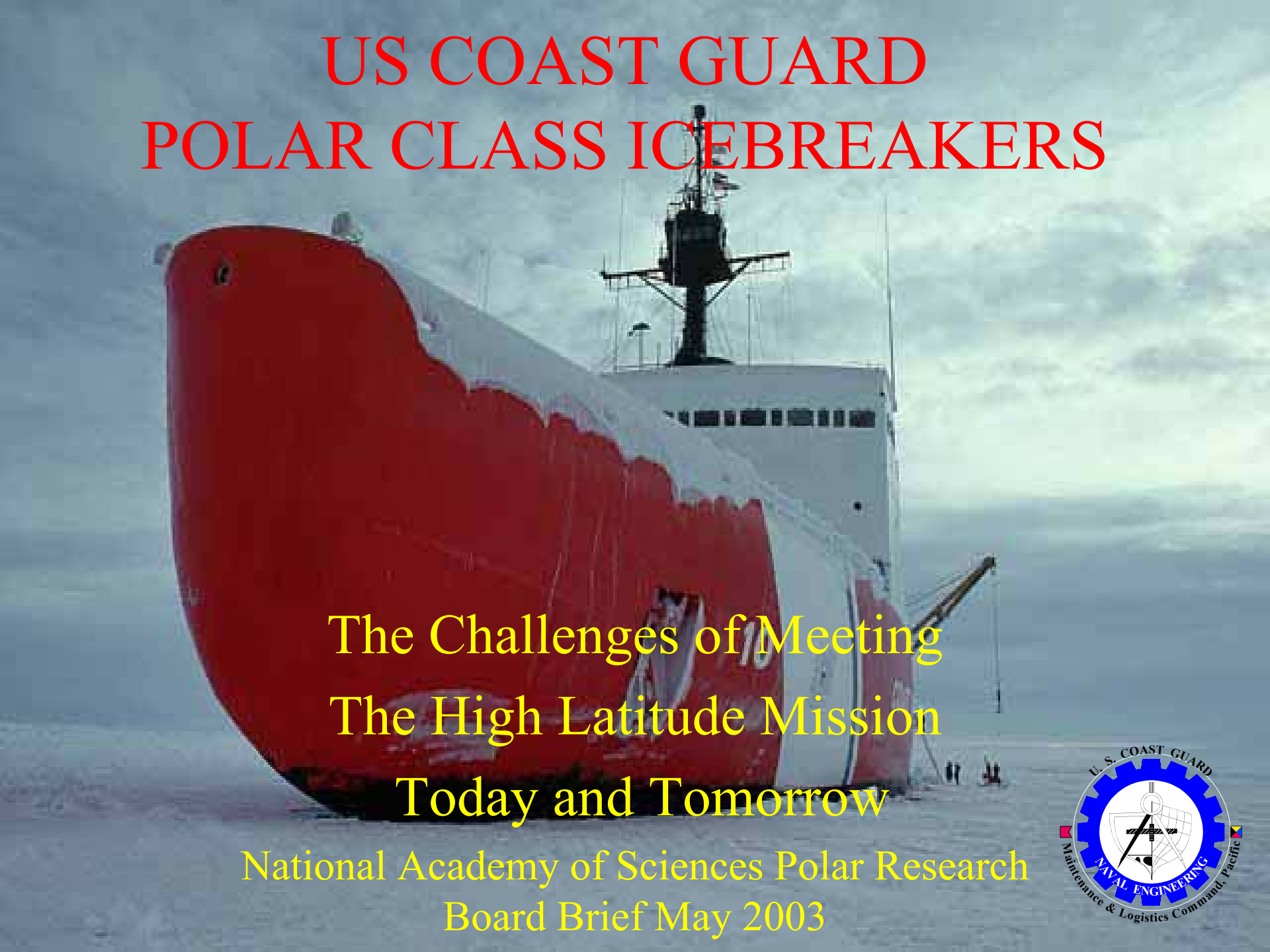
US COAST GUARD
POLAR CLASS ICEBREAKERS

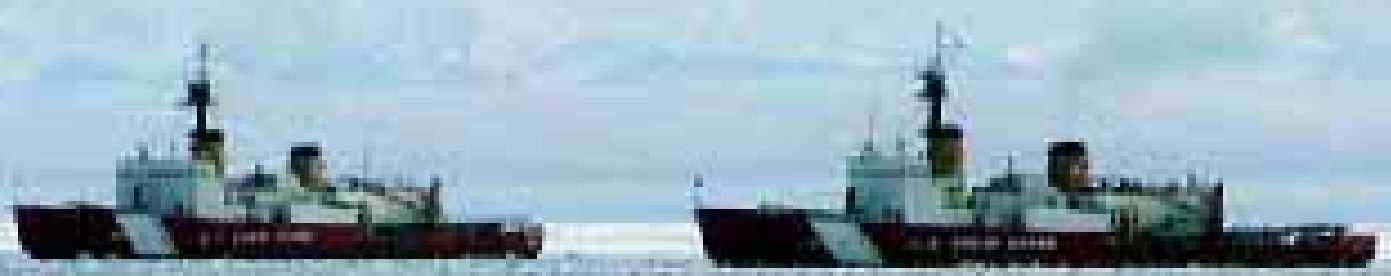


The Challenges of Meeting The High Latitude Mission Today and Tomorrow

National Academy of Sciences Polar Research Board Brief May 2003

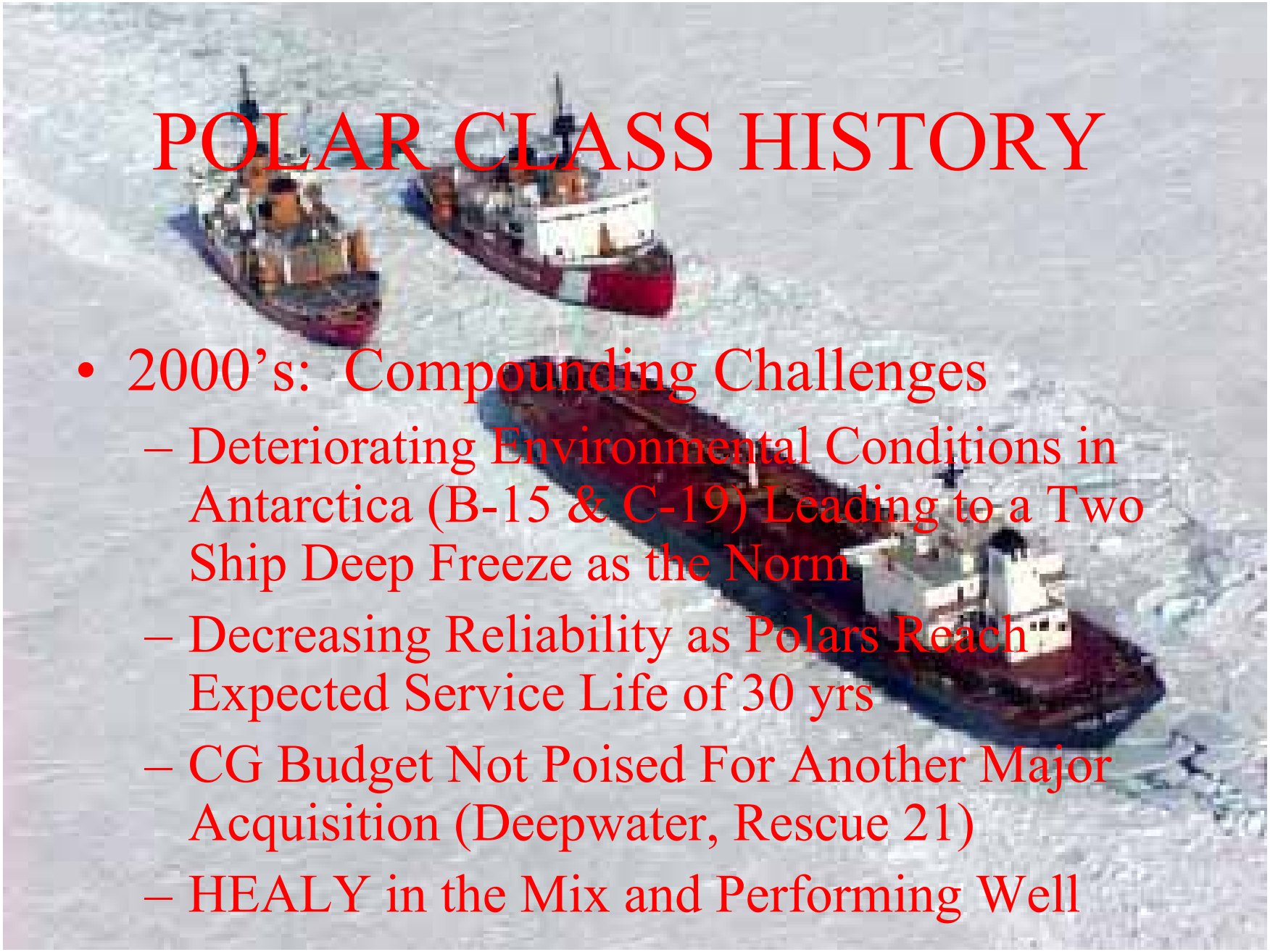
U. S. COAST GUARD
NAVAL ENGINEERING
Maintenance & Logistics Command, Pacific

POLAR CLASS HISTORY



- 1970's: Polars Commissioned in '76 & '77
- 1980's: Hone Op Envelope & Maintenance Practices
  - Reliable Operation w/Wind Class & Glacier
- 1990's: Polars Only Remaining High Lat Icebreakers
  - Polar Science Upgrades (PSU) 1 & 2 Add Significant Science Capabilities to Polars
  - Machinery Control And Monitoring System (MCAMS) Upgrades Propulsion Control System
  - Reliability Improvement Project (RIP) targets specific mission critical, low reliability systems for upgrade and improvement.

POLAR CLASS HISTORY



- 2000's: Compounding Challenges
  - Deteriorating Environmental Conditions in Antarctica (B-15 & C-19) Leading to a Two Ship Deep Freeze as the Norm
  - Decreasing Reliability as Polars Reach Expected Service Life of 30 yrs
  - CG Budget Not Poised For Another Major Acquisition (Deepwater, Rescue 21)
  - HEALY in the Mix and Performing Well

CHALLENGES

- Polar Sea Deep Freeze 2003 Casualties & Repairs
- Reliability Improvement Project (RIP)
- Service Life Evaluation Board (SLEB)
- Service Life Extension Project (SLEP)

POLAR SEA DF 2003 CASUALTIES

- Starboard Propeller Hub Blade Loss
- Port Propeller Hub Body Oil Leak
- #3 Main Gas Turbine (MGT) Hot Section Damage (Total Loss)
- #2 & #3 MGT Inlet Guide Vane Casing Damage (Inplace Repair on #2 MGT)
- Towing Bitt

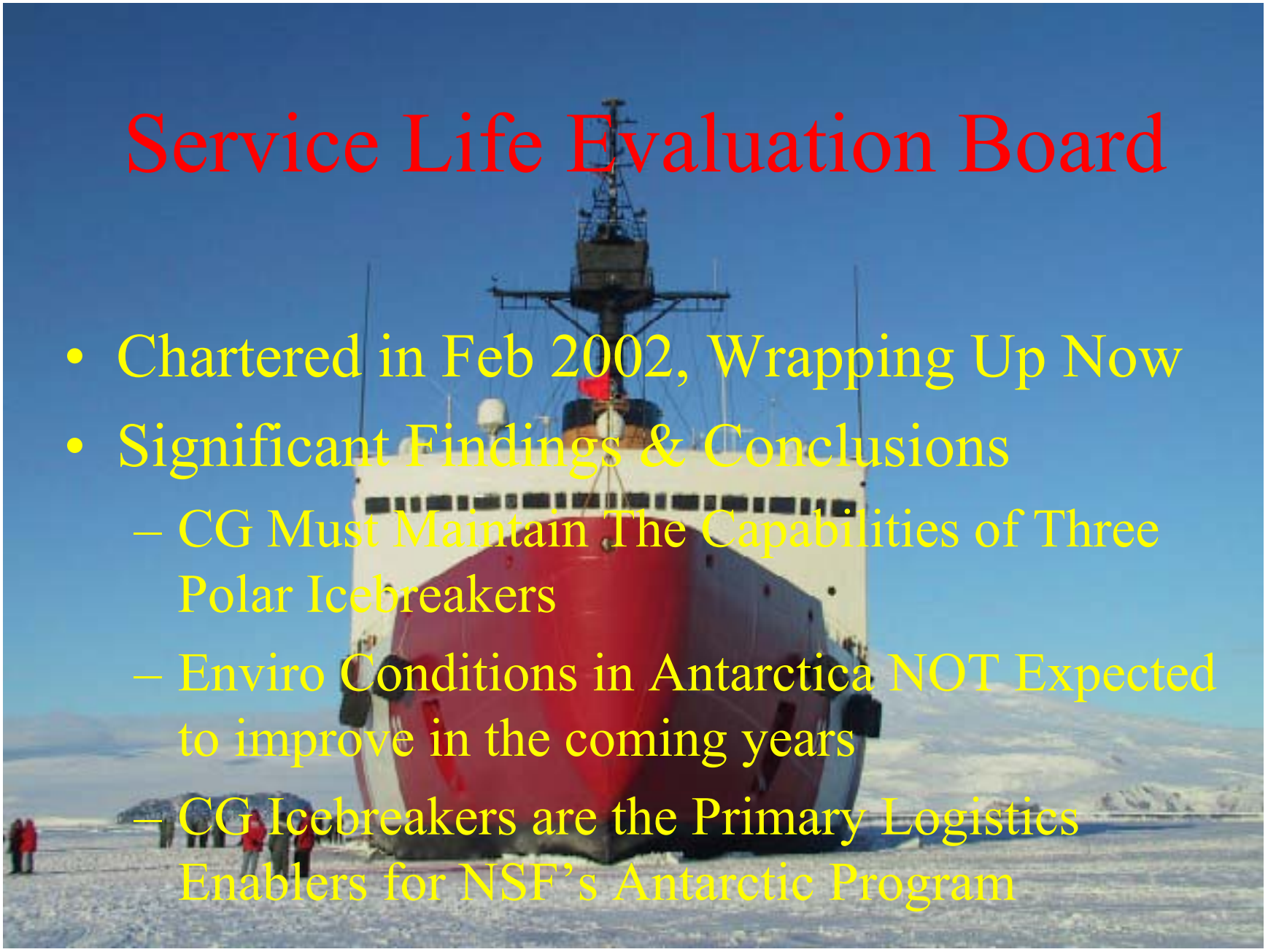
POLAR SEA DF 2003 CASUALTIES

- Repair Plan: Assumes Both Ships for DF04
  - PSEA Regular Drydocking (DD) moves from 11 Feb 04-04 May 04 to 08 Jul 03-30 Sep 03, includes all emergency & recurring repairs.
  - Prop Hubs off of PSTAR in March 03, Accelerated Overhaul for Reinstall on PSEA.
  - PSTAR Ready for Sea 01 Nov 03
  - PSEA Ready for Sea 01 Dec 03
  - Spare Blade in Germany

Reliability Improvement Project

- Project Never Intended as a Mid-Life Overhaul
- Only Funded to ~50% Over Life of Program ($46M Funded vice $81M Requested)
- Project Manager Passed Away in Nov 02 (Driving Force)
- All money zeroed in FY 04-05
  - Civ & Military Billets Begin to Expire this FY
- Funding May Be Restored Via OE Account (AFC 45 + up)
- Next Phase of Work is Highly Intrusive & Upgrades Systems That Would Be Removed In SLEP
  - Alco Engine Renewals, Generator Up-rating, CPP Open Loop
- Work Would Have to be Completed in the Summer Season in Two Ship DF Scenario

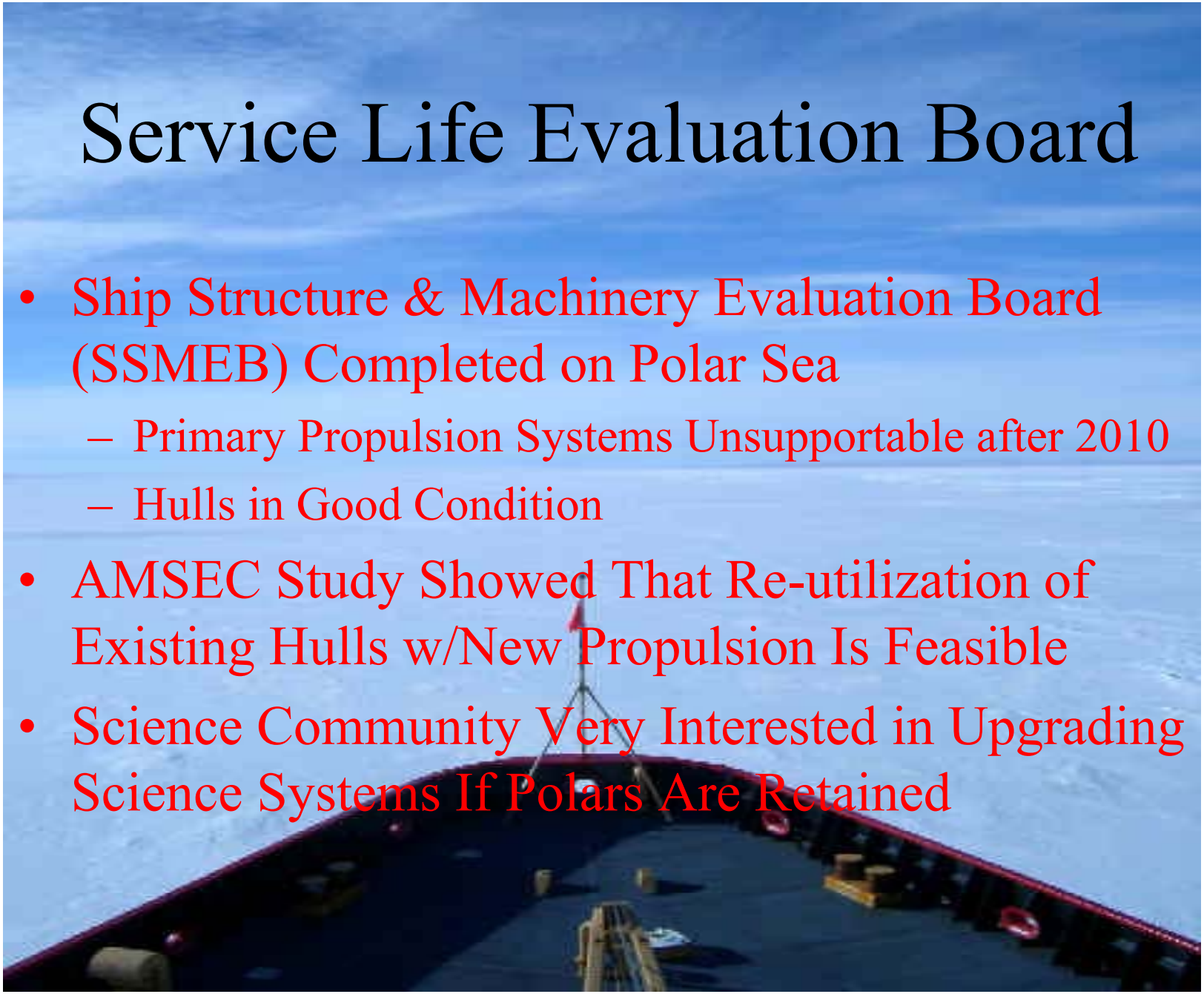
Service Life Evaluation Board



- Chartered in Feb 2002, Wrapping Up Now
- Significant Findings & Conclusions
  - CG Must Maintain The Capabilities of Three Polar Icebreakers
  - Enviro Conditions in Antarctica NOT Expected to improve in the coming years
  - CG Icebreakers are the Primary Logistics Enablers for NSF's Antarctic Program

Service Life Evaluation Board

- Ship Structure & Machinery Evaluation Board (SSMEB) Completed on Polar Sea
  - Primary Propulsion Systems Unsupportable after 2010
  - Hulls in Good Condition
- AMSEC Study Showed That Re-utilization of Existing Hulls w/New Propulsion Is Feasible
- Science Community Very Interested in Upgrading Science Systems If Polars Are Retained



Service Life Evaluation Board

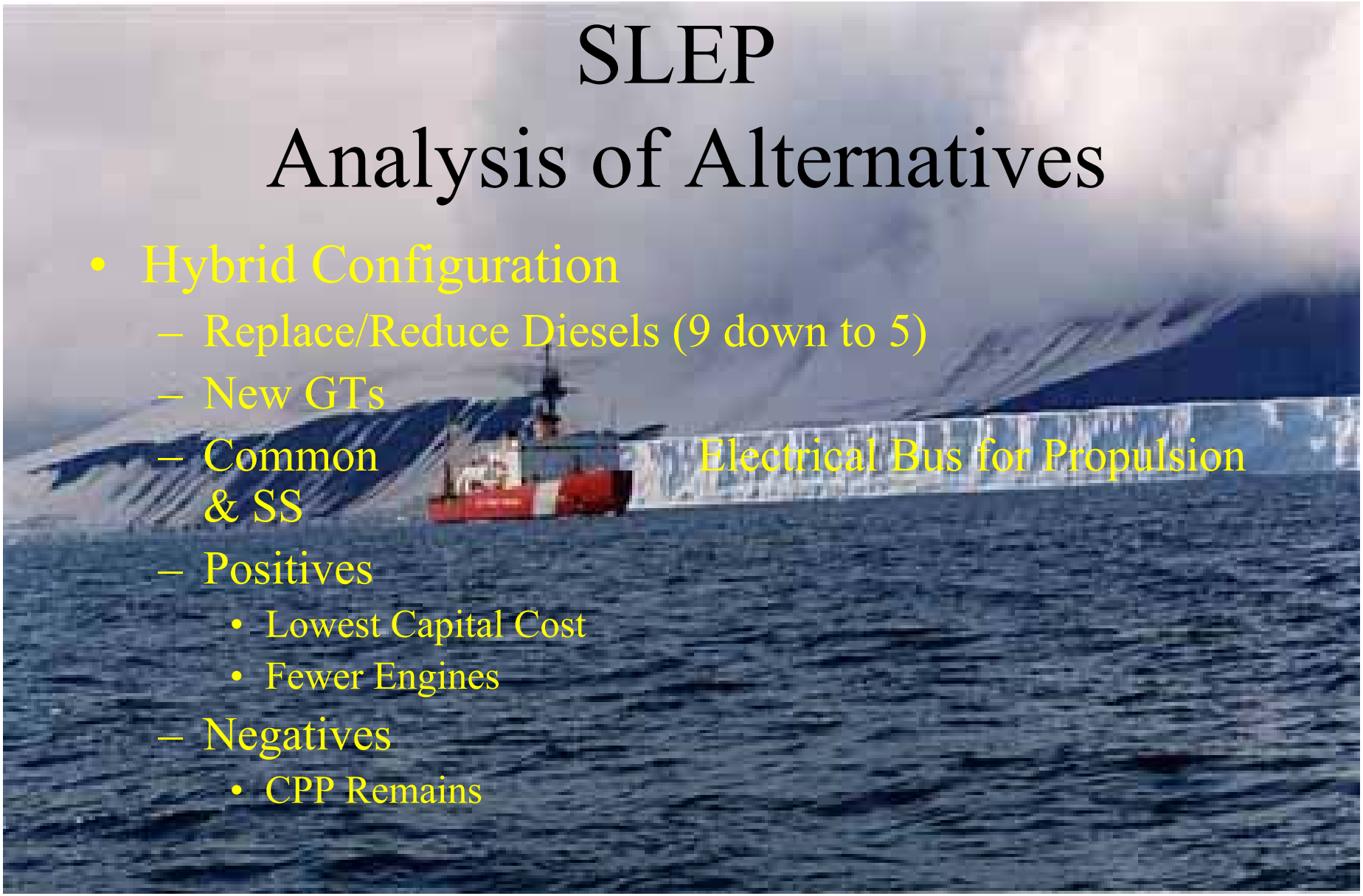
- Recommendations of the SLEB
  - Near Term (1-5yrs): $7M/yr AFC 45 Plus-Up
    - Backfills RIP Canx, Closes SSL Delta, Stops Polar $$ Impact on Other PacArea Cutter Maintenance
    - Must do this just to keep ships running to 2010
  - Long Term (5-30yrs): Service Life Extension Project (SLEP)
    - Utilize Existing Hulls w/New Propulsion System
    - Must begin program immediately

Service Life Extension Project (SLEP)

- Ship Structure & Machinery Evaluation Board (SSMEB): Internal CG Assessment of Capital Asset Status
  - 25+ Years Remaining In the Hulls
  - 10 Years Remaining in Science Systems
  - 4-7 Years Remaining in Machinery/Electrical Systems (CPP, GTs, Diesels unsupportable after 2010)
  - Two Ship Deep Freeze Will Only Accelerate the Demise of the Limited Remaining Service Life

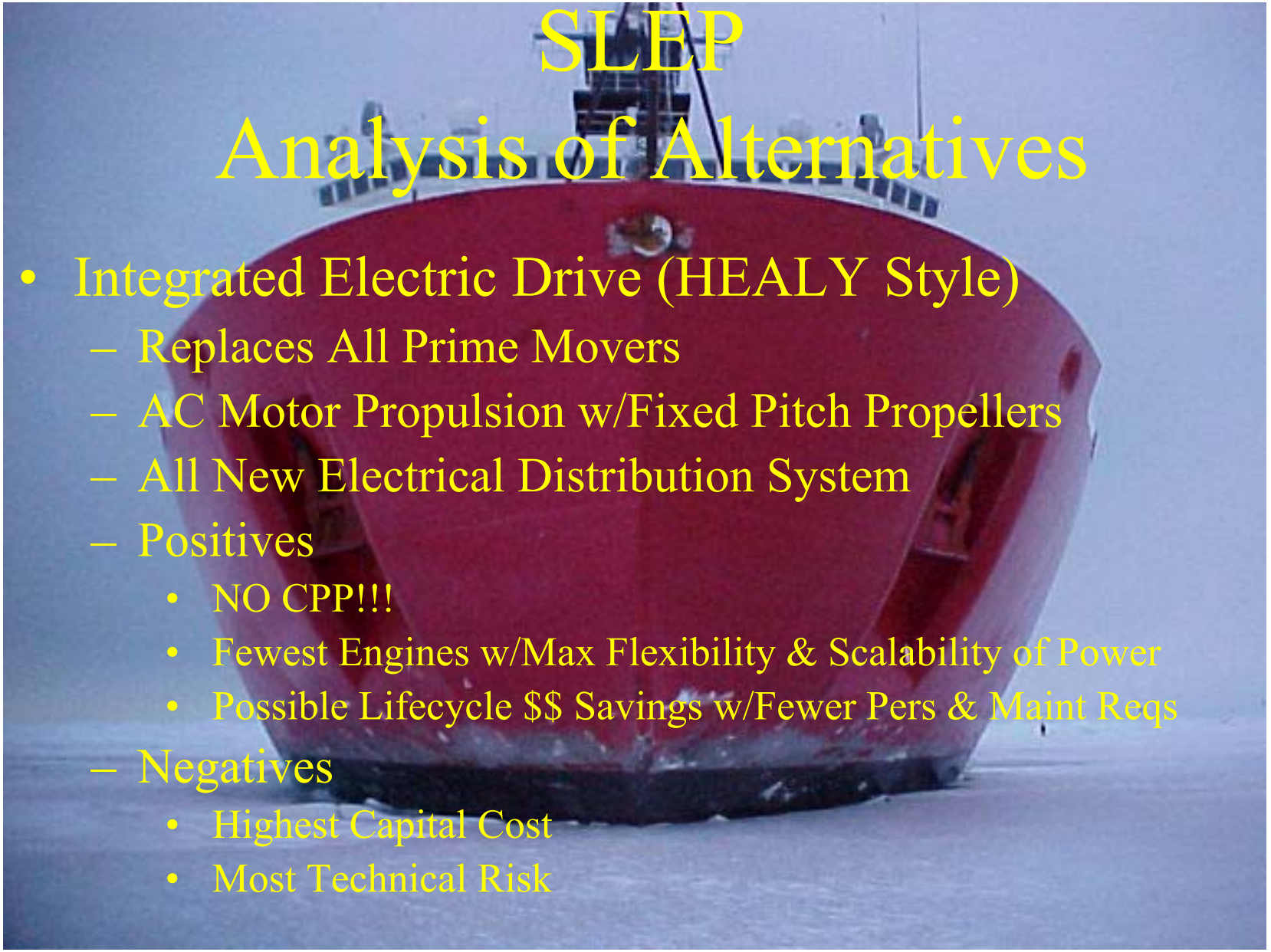
SLEP
Analysis of Alternatives

- Keep Existing Configuration
  - Finish RIP
  - New GTs & Propeller Hubs
  - Positives
    - Low Technical Risk
    - Less Costly Than Integrated Electric Drive
    - Maintenance and Operations Well Understood
  - Negatives
    - CPP Remains
    - Burdensome Maintenance Requirements Remain



SLEP
Analysis of Alternatives

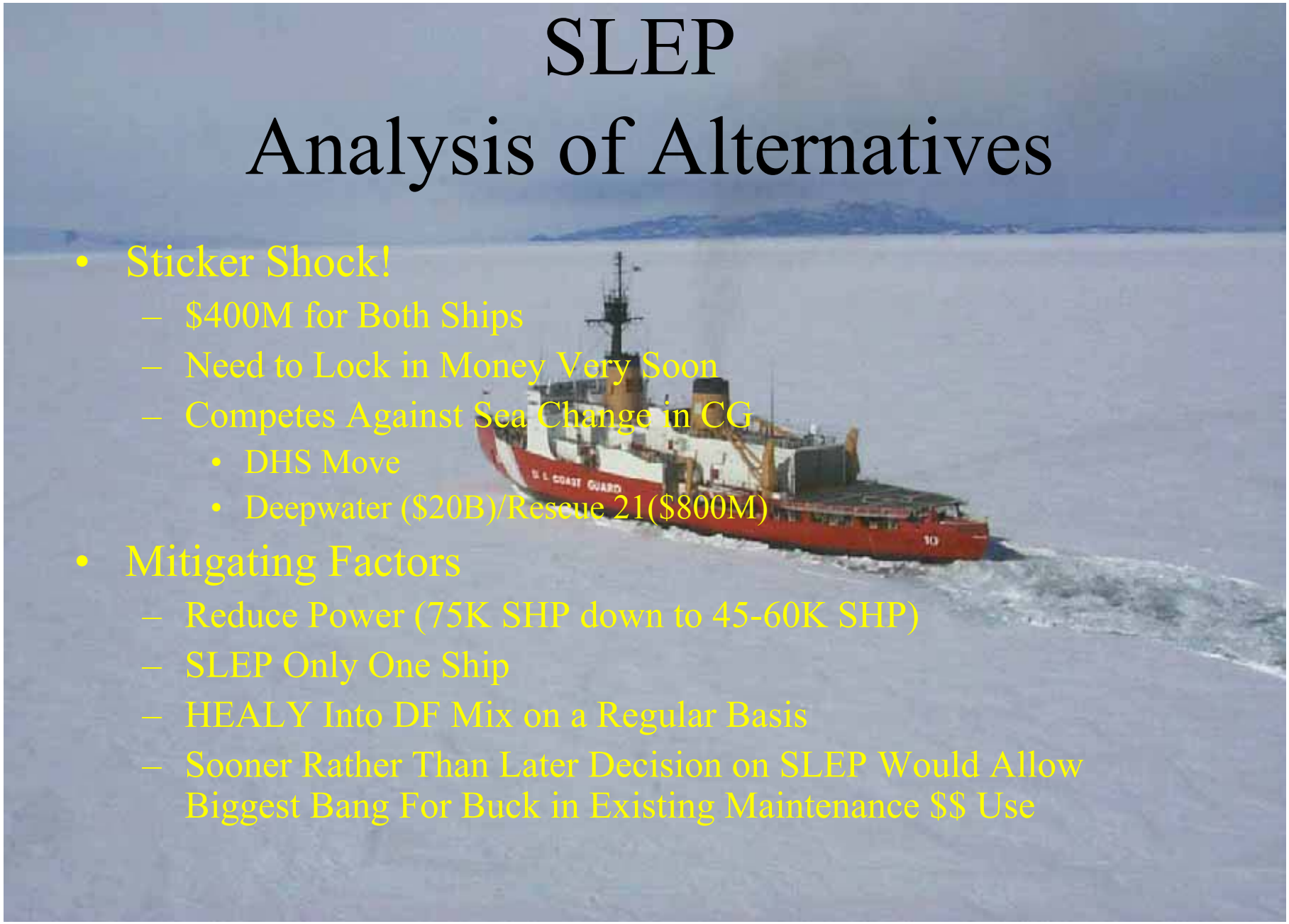
- Hybrid Configuration
  - Replace/Reduce Diesels (9 down to 5)
  - New GTs
  - Common Electrical Bus for Propulsion & SS
  - Positives
    - Lowest Capital Cost
    - Fewer Engines
  - Negatives
    - CPP Remains



SLEP
Analysis of Alternatives

- Integrated Electric Drive (HEALY Style)
  - Replaces All Prime Movers
  - AC Motor Propulsion w/Fixed Pitch Propellers
  - All New Electrical Distribution System
  - Positives
    - NO CPP!!!
    - Fewest Engines w/Max Flexibility & Scalability of Power
    - Possible Lifecycle $$ Savings w/Fewer Pers & Maint Reqs
  - Negatives
    - Highest Capital Cost
    - Most Technical Risk

SLEP
Analysis of Alternatives



- Sticker Shock!
  - $400M for Both Ships
  - Need to Lock in Money Very Soon
  - Competes Against Sea Change in CG
    - DHS Move
    - Deepwater ($20B)/Rescue 21($800M)
- Mitigating Factors
  - Reduce Power (75K SHP down to 45-60K SHP)
  - SLEP Only One Ship
  - HEALY Into DF Mix on a Regular Basis
  - Sooner Rather Than Later Decision on SLEP Would Allow Biggest Bang For Buck in Existing Maintenance $$ Use

Perfect Storm Conditions

- Little or No Remaining Service Life
  - MAJOR Casualties Now the Norm On Both Ships, Every Mission
- Two Ship Deep Freeze Exacerbates Perilous Materiel Condition of the Icebreakers
  - Both Ships Now On Tap to Do the Hardest Mission Year In and Year Out
- Yet Another Major Acquisition Competing in a Tough Fiscal Environment
  - Effectively Cancelled RIP, No SLEP Money ID'd, Congressional Rescission